

Renewable Energy Markets in Developing Countries

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Paradigm Shift: From Demonstrations to Sustainable Markets

A growing body of experience suggests that successful approaches to promoting renewable energy should expand and sustain markets for applications offering the economic and social benefits most needed

A. Market Indicators in Five Application Categories

1. Rural residential and community lighting, TV, and telephony
2. Rural small industry, agriculture, and other productive uses
3. Grid-based power generation
4. Residential/commercial cooking and hot water
5. Transport fuels

B. Emerging Lessons Suggested by Experience

C. Global Environment Facility Strategies

1. Rural Residential and Community Lighting, TV, and Telephony

*400 million households—a third of the world's population—
do not have access to electricity!*

- Over 50 million households served by small-hydro village-scale mini-grids
- 10 million households get lighting from biogas
- 1.1 million households have “solar home systems” or solar lanterns
- Over 200,000 households served by household-scale wind power
- 10,000 households served by solar/wind/diesel hybrid mini-grids

2. Rural Small Industry, Agriculture, and Other Productive Uses

“Productive uses” are those which increase incomes or provide social services beyond home lighting and entertainment

- Up to 1 million water pumps driven by wind turbines and up to 20,000 water pumps powered by solar PV
- Up to 60,000 small enterprises powered by small-hydro village-scale mini-grids
- Thousands of communities receive drinking water from solar PV-powered purifiers/pumps

3. Renewable Grid-Based Electricity Generation Capacity

Installed as of 2000 (megawatts)

Technology	World—all Countries	Developing countries
Small hydropower	43,000	25,000
Biomass power	32,000	17,000
Wind power	18,000	1,700
Geothermal power	8,500	3,900
Solar thermal power	350	0
Solar photovoltaic power (grid)	250	0
Total renewable power capacity	102,000	48,000
Large hydropower	680,000	260,000
Total world electric power capacity	3,400,000	1,500,000

Source: "Renewable Energy Markets in Developing Countries," E. Martinot, A. Chaurey, D. Lew, J. Moreira, N. Wamukonya, *Annual Review of Energy and the Environment* 27: 309-348 (2002).

4. Residential/Commercial Cooking and Hot Water

Traditional biomass use — wood, crop wastes, dung, and charcoal — provides 30-45% of primary energy supply in many developing countries

- 220 million households have more-efficient biomass stoves
- 10 million households have solar hot water systems
- 800,000 households have solar cookers

5. Transport Fuels

Brazil is the single largest producer and consumer of ethanol in the world, with over 40% of total automobile fuel from ethanol

- 14 billion liters per year ethanol vehicle fuel produced from biomass
- 180 million people live in developing countries mandating mixing of ethanol with gasoline

Emerging Lessons: Impacts on Rural Development

After decades of work, we still know very little about the development impacts of renewable energy!

- Social benefits and quality of life, rather than income and economic benefits, have driven markets for renewable energy in rural areas
- Experience with “productive uses” of renewable energy is still in its infancy and deserves much greater attention from donors, development agencies, and governments
- Economic benefits from renewables are more likely in rural areas that can incorporate the additional energy dimension into existing development activities for water, health, education, agriculture, and entrepreneurship
- Published studies of income generation and economic benefits from renewable energy are still limited and call for further research

Emerging Lessons: Affordability, Consumer Credit, and Rentals

Can households “afford” to buy renewable energy based on savings of avoided kerosene, candles, and battery purchases?

- Historically, affordability of rural energy has been addressed through government subsidies, donor programs, and private cash sales of small systems
- New approaches to affordability are emerging, including vendor-supplied credit, microcredit, and rental models, but are still largely untested
- Credit risk is a serious concern of both financiers and dealers and makes credit sales challenging
- Lower income rural households will need long-term credit or rental options
- Even with credit or rentals, lower incomes groups will only benefit with targeted policies, including subsidy policies, justified by development goals

Emerging Lessons: Equipment Subsidies and Market Distortions

Donors are still undermining markets with capital cost subsidies and donated equipment

- Subsidies are unlikely to lead to sustainable markets unless they explicitly create the conditions whereby they are no longer needed (i.e., “smart” subsidies)
- Subsidies can undermine private investments and business in new markets and should be applied with attention to private-sector conditions in a particular market
- Subsidies can be used effectively to build up initial market volume, local expertise, user awareness, appropriate technology adaptation, quality standards, and entrepreneurial activities
- Subsidies are more effective when tied to operating performance rather than investment
- Continuing subsidies may always be needed for poorer segments of the population

Emerging Lessons: Enterprise Development, Financing, Viability

The track record of donor programs is poor in creating and sustaining rural enterprises for delivering renewable energy services

- A few donor programs have effectively assisted rural renewable energy-based enterprises to build a sustainable and viable business
- Rural energy enterprises face a high-risk, low-margin business with high transaction costs
- Commercial banks and financial intermediaries are key decision makers, who must understand the technologies and manage risks
- Demonstration of viable business models that eventually show sustained profits for the enterprise is key to achieving market sustainability

Emerging Lessons: Policies/Financing for Private Power Producers

Many developing countries have regulatory frameworks for independent power producers, but still lack specific renewable energy policies

- Policies that promote production-based incentives rather than investment-based incentives are more likely to spur industry performance and sustainability
- Power-sector regulatory policies for renewable energy should support IPP frameworks that provide incentives and long-term stable tariffs for private power producers
- Regulators need skills to understand the complex array of policy, regulatory, technical, financing, and organizational factors that influence whether renewable energy producers are viable
- Financing for renewable power projects is crucial but elusive

Emerging Lessons: Market Facilitation Organizations (MFOs)

Traditionally industry associations, a new generation of MFOs has emerged for renewable energy, including business-oriented NGOs

- MFOs can be powerful market stimulants but very few exist
- Public-private MFOs most likely need full public funding to begin, but eventually can become partly self-supporting through private contracts
- Very few people are thinking about the power of MFOs to stimulate renewable energy market development

The Global Environment Facility (GEF)

*Intergovernmental foundation created out of 1992 Rio Earth Summit
to address sustainable development*

- Focus on climate change, ozone, biodiversity, and international waters
- Designated “financial mechanism” of UN climate change convention
- Governed by 32-member council of representatives from both developed and developing country governments
- “Implementing agencies” prepare and execute projects: World Bank and IFC, UN Development Program, UN Environment Program, regional devel. banks
- Climate change: \$1.5 billion in grants to 300 projects, with additional \$6 billion in cofinancing from governments, multilaterals, private sector
- Renewable energy: \$700 million in grants and \$3 billion in co-financing to over 80 projects. Currently about \$80 million/year allocated.

GEF Market Facilitation Strategies

The GEF will only be successful if results remain sustainable after project completion and are replicated on larger scales

- Help **private firms** enter new markets, innovate, and lower costs, by providing financing, technical assistance, limited subsidies, and marketing support
- Build **abilities of government** agencies and NGOs to promote renewable energy development, including market assessments and policy studies
- Create new **financing vehicles** like revolving funds, credit lines, and contingent business loans that are forgivable under specified conditions
- Develop or strengthen **regulatory frameworks** for independent power producers, power-purchase tariffs, and off-grid rural energy concessions
- Promote **know-how transfer** to enhance domestic capabilities (e.g., technology demonstrations and licensing, study tours, standards)

Renewable Energy “Experience and Lessons” Publications

“Renewable Energy Markets in Developing Countries,” E. Martinot, A. Chaurey, D. Lew, J. Moreira, N. Wamukonya, *Annual Review of Energy and the Environment* 27: 309-348 (2002).

“Grid-Based Renewable Energy in Developing Countries: Policies, Strategies and Lessons from the GEF” (2002)

“World Bank/GEF Solar Home Systems Projects: Experience and Lessons Learned 1993-2000” (2001)

“The GEF Solar PV Portfolio: Emerging Experience and Lessons” (2000)

“Promoting Energy Efficiency and Renewable Energy: GEF Climate Change Projects and Impacts” (2000)

Copies of publications available at <http://www.gefweb.org> (results => experience and lessons) and at http://www.martinot.info/re_publications.htm.

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